REMARKS/ARGUMENTS

Favorable reconsideration of this application in light of the following discussion is respectfully requested.

Claims 39-45 and 47-77 are presently pending in this case.

In the outstanding Official Action, Claims 39-45 and 47-56 were rejected under 35 U.S.C. §103(a) as unpatentable over Deguchi et al. (European Patent Application Publication No. 0 844 319, hereinafter "Deguchi"); and Claims 39-45 and 47-56 were rejected under 35 U.S.C. §103(a) as unpatentable over Deguchi in view of Ekstrom et al. (U.S. Patent No. 6,914,025, hereinafter "Ekstrom").

The outstanding rejections of Claims 39 and 54 as unpatentable over Deguchi and Ekstrom are respectfully traversed.

Claims 39 and 54 recite in part "the grown layer of CVD diamond has an exposed surface with at least 30% of the exposed surface being occupied by diamond grains with a grain size of at least four times a thickness of the layer of CVD diamond."

In growing a CVD diamond layer on a substrate, the nature of the surface on which the diamond growth occurs is important. Where that substrate surface contains diamond, then homoepitaxial growth of diamond occurs on that diamond. This is the case with the presently claimed invention. The diamond loaded material has diamonds located in the outer surface and it is on these diamonds that the homoepitaxial CVD growth of diamond occurs.

However, where the substrate does not contain diamond at the surface, e.g. silicon or carbide substrates, the formation of diamond nuclei (commonly referred to as "nucleation") on the surface of the substrate of on which CVD diamond growth is to occur is necessary. This nucleation problem is the problem Deguchi is trying to solve. This is because the Deguchi substrate is a non-diamond containing material, and thus Deguchi describes a method of controlling nucleation so that very high nucleation densities can be achieved.

Deguchi describes ultra-fine grained thin diamond films and making them by a method that enhances the nucleation rate. This is exemplified by the description in the background of the invention at column 1, lines 52-55 in which the problem being solved is described as "Such diamond films obtained by the conventional techniques are, however, comparatively large grained in the crystal sizes and the continuous films are comparatively thick." Deguchi also makes the point that thin layers made by conventional methods are not continuous and this problem is one that Deguchi's invention solves (i.e. making thin continuous layers of very fine grained material). Further, it is at the interfaces between the substrate and the diamond layer that the film is discontinuous, and it remains discontinuous in this region even when a very thick layer is grown as the CVD growth process just covers up what has gone before. The fact that the interface is discontinuous when made by the conventional methods described by Deguchi means that the thermal resistance across the interface is significantly increased compared with the bulk material, thereby degrading the thermal performance of the substrate and diamond coating when measured together. Further, if the method of Deguchi is used to produce a continuous interface and a sufficiently thick layer, the fine grain size would be detrimental to the thermal conductivity as the presence of the grain boundaries causes scattering of the phonons by which the heat is conducted in diamond.

The homoepitaxial CVD diamond growth on a diamond-containing surface of a diamond loaded substrate in the presently claimed invention results in the claimed feature of "the grown layer of CVD diamond having an exposed surface with at least 30% of the exposed surface being occupied by diamond grains with a grain size of at least four times the thickness of the layer of CVD diamond." A CVD diamond layer having these characteristics has excellent heat spreading capability because of (a) the homoepitaxial diamond growth across the interface between the diamond loaded material and the layer of CVD diamond and

(b) the large diamond grains in the layer, relative to the layer thickness. Neither of these two features is to be found in Deguchi. Deguchi has a CVD diamond layer bonded to a non-diamond substrate giving rise to high thermal resistance across the interface. Further, Deguchi has fine diamond grain size in his diamond layer and hence lower thermal conductivity.

The Deguchi structure comprises a thin layer of fine-grained diamond on a non-diamond substrate. The outstanding Office Action asserts that "embedding" as described by Deguchi provides a diamond loaded substrate. However, as noted previously in the response filed November 5, 2007, it is respectfully submitted that the nuclei of Deguchi are not "embedded" in the surface on which they are located.

Further, at the interface, prior to diamond growth, Deguchi deposits a very high number density ($>10^{10}$ cm^{-2}) of very small (~0.1 μm linear dimension or less) nuclei. The nuclei from which diamond growth occurs are thus not part of the substrate, but are added to its surface to facilitate subsequent diamond growth and in the final product form part of the diamond layer. In the absence of such nuclei, there will be no diamond growth (or a negligible amount of diamond growth) on a substrate that is neither diamond nor has diamond grains exposed at its surface. Where the substrate is either a diamond substrate or contains diamond particles, as is the case with the diamond-loaded substrate of the claimed invention, that are exposed at the surface, a nucleation process is not required and homoepitaxial CVD diamond growth can occur.

Deguchi describes providing a high density of growth nuclei, and this is because he grows on a non-diamond substrate. That diamond layer has a sharp interface with a non-diamond substrate of poor thermal conductivity properties. The non-diamond substrate of Deguchi will also have considerably poorer heat spreading properties compared with the diamond loaded substrate recited in Claims 39 and 54 of this application.

In paragraphs 5 to 7 and again in paragraphs 15 to 17, the outstanding Office Action mentions epitaxial area. However, this appears to be a misunderstanding of Claims 39 and 54. Claim 39 recites "the layer of CVD diamond is bonded to the exposed diamond particles of the DL material at least in part by epitaxy" and "the grown layer of CVD diamond has an exposed surface with at least 30% of the exposed surface being occupied by diamond grains with a grain size of at least four times a thickness of the layer of CVD diamond." These characteristics are a consequence of enhanced epitaxy (see page 8 of the specification) and result in improved heat spreading properties. This is not known in, nor taught by, Deguchi, as conceded in paragraphs 5 and 15 of the outstanding Office Action. As noted previously, *In re Antonie* holds that a particular parameter must first be recognized as a result-effective variable, i.e., a variable which achieves a recognized result, before the determination of the optimum or workable ranges of said variable might be characterized as routine experimentation. *In re Antonie*, 559 F.2d 618, 195 USPQ 6 (CCPA 1977). See also MPEP §2144.05(II)(B). As the outstanding Office Action conceded in paragraphs 5 and 15 that Deguchi is silent with respect to this feature, and did not cite any portion of Ekstrom for this subject matter, neither Deguchi nor Ekstrom can describe that the grain size of an exposed surface of a grown layer of CVD diamond occupied by diamond grains is a result effective variable. Therefore, the subject matter of amended Claim 39 ***cannot*** be considered a matter of routine experimentation.

Further, with respect to the assertion in paragraph 6 of the outstanding Office Action that this subject matter is not critical, it was previously noted that the present specification at page 8, paragraph 2 discusses the desirability of having a large number of large particles in the growth (exposed) surface of the CVD diamond layer. Thus, it is respectfully submitted that the subject matter of amended Claim 39 is critical and thus should be given patentable weight.

Therefore, as Deguchi and Ekstrom do not teach or suggest the subject matter of Claim 39, and the subject matter of Claim 39 ***cannot*** be considered a matter of routine experimentation, it is respectfully submitted that neither Deguchi nor Ekstrom teaches or suggests "a layer of CVD diamond" as defined in Claims 39 and 54. Consequently, Claims 39 and 54 (and Claims 40-45, 47-53, 55, and 56 dependent therefrom) are patentable over Deguchi and Ekstrom.

Accordingly, the pending claims are believed to be in condition for formal allowance. An early and favorable action to that effect is respectfully requested.

Respectfully submitted,

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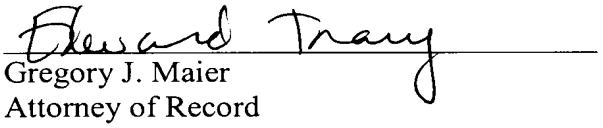

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